WE CLAIM:

Sub a1

1. A method of determining concentrations of a plurality of constituent components of whole undiluted blood, including:

generating a plurality of radiation frequencies each determined to minimize the effect of radiation scattering and to maximize radiation absorbance by whole, undiluted blood;

irradiating a sample of whole, undiluted blood with said plurality of radiation frequencies, through a depth of said sample chosen to minimize radiation scattering by whole, undiluted blood;

detecting intensities of said plurality of radiation frequencies, after passing through said depth of said sample, at a distance from said sample, and over a detecting area, both chosen to minimize the effect of radiation scattering by whole, undiluted blood; and

calculating concentrations of each of a plurality of constituent components of said sample of whole, undiluted blood, based upon detected intensities of said plurality of radiation frequencies, and upon predetermined molar extinction coefficients for each of said plurality of constituent components at each of said plurality of radiation frequencies.

2. A method as recited in claim 1, wherein said depth of said sample is in the range of 80 to 150 micrometers.

3. A method as recited in claim 1, wherein said detecting area is at least approximately 600 square millimeters.

4. A method as recited in claim 3, wherein said distance from said sample is within the range of 2 to 10 millimeters.

5. A method as recited in claim 1, wherein said step of detecting is performed over a half-aperture angle of radiation emanating from said sample of at least approximately 70°.

6. A method as recited in claim 1, wherein said step of generating further comprises the steps of:

generating white light; and

passing generated white light through a plurality of interference filters, corresponding to said plurality of radiation frequencies.

7. A method as recited in claim 1, wherein said step of generating further comprises the steps of:

providing a tunable source of laser radiation; and

selectively tuning said tunable source of laser radiation to each of said plurality of radiation frequencies.

8. A method as recited in claim 1, wherein said step of generating further comprises the steps of:

generating light using light-emitting diodes; and

passing light generated by said light-emitting diodes through a plurality of interference filters corresponding to said plurality of radiation frequencies.

9. A method as recited in claim 1, wherein said step of generating further comprises the steps of:

generating white light; and

passing generated white light through a controllable monochromator to selectively produce each of said plurality of radiation frequencies.

10. A method as recited in claim 1, wherein said step of generating further comprises the steps of:

generating white light; and

passing generated white light through a controllable diffraction grating to produce said plurality of radiation frequencies.

11. A method as recited in claim 1, wherein said plurality of radiation frequencies are equal in number to said ~~plurality of~~ constituent components.

12. A method as recited in claim 11, wherein said step of calculating comprises calculating concentrations of each of said plurality of constituent components using the Beer-Lambert Law of absorption spectroscopy.

13. An apparatus for determining concentrations of hemoglobin species in whole blood, comprising:

a light source for generating monochromatic light;

a light detector, having a large detecting area to minimize the effect of light scattering by whole blood, for producing a detector output signal indicative of optical density of a sample of whole, undiluted blood under test;

a cuvette, located between said light source and said light detector and providing a short light absorbance path to minimize the effect of light scattering by whole blood, for containing said sample of whole, undiluted blood under test; and

a controlling and calculating unit connected to said light source and to said light detector, for controlling said light source and for calculating a concentration of at least ~~one~~ three hemoglobin species contained within said sample of whole, undiluted blood under test, as a function of said detector output signal.

14. In an apparatus for calculating concentrations of hemoglobin species in whole blood, an optical device comprising:

a controllable source of monochromatic light;

a cuvette for holding a sample of whole, undiluted blood, said cuvette providing an optical absorbance path through said sample of whole, undiluted blood to minimize the effect of light scattering by said sample; and

a light detector positioned to receive and detect light from said source of light passing through said optical absorbance path, said light detector being positioned a distance from said cuvette and having a light detecting area, both chosen to minimize the effect of light scattering by said sample.